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BIG DATA AND ANALYTIC IN FINANCIAL SERVICES: APPLICATION AND TRENDS

R K Jena*
* Institute of Management Technology, Nagpur, India

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ABSTRACT

The financial services industry was recently identified as the industry most likely to be disrupted and transformed by millennia's. The application of Big data analytics in financial services is advanced and pervasive. The changes in the banking and financial services industry in the coming years will be seismic. As an example, global banks are setting up innovation centers and specialized teams to focus on blockchain, heralded as a disruptive force that offers multiple opportunities such as overhauling existing banking infrastructure, speeding up settlements and streamlining stock exchanges. This article briefly reviews the successful evolution of big data analytics in the financial services.

INTRODUCTION

There has been an explosion in the velocity, variety and volume of financial data. Social media activity, mobile interactions, server logs, real-time market feeds, customer service records, transaction details, information from existing databases – there's no end to the data generation. To make sense of these giant data sets, companies are increasingly turning to data scientists for answers. These numbers experts are:

- Capturing and analyzing new sources of data, building predictive models and running live simulations of market events
- Using technologies such as Hadoop, NoSQL and Storm to tap into non-traditional data sets (e.g., geolocation, sentiment data) and integrate them with more traditional numbers (e.g., trade data)
- Finding and storing increasingly diverse data in its raw form for future analysis

They've been aided in this quest by the development of cloud-based data storage and the surge of sophisticated (and sometimes free or open-source) analytics tools. A serendipitous confluence of circumstances is leading to a host of new financial applications

The increasing volumes of 'big data' reflecting various aspects of our everyday activities represent a vital new opportunity for scientists to address fundamental questions about the complex world we inhabit[1-7]. Financial markets are a prime target for such quantitative investigations [8-9]. Movements in the markets exert immense impacts on personal fortunes and geopolitical events, generating considerable scientific attention to this subject[10-19]. For example, a range of recent studies have focused on modeling financial markets [20-23] and on performing network analyses [23-25].

According to Forbes[26], 87% of companies think big data will make big changes to their industries before the end of the decade. Even more think that not having a big data strategy will cause their companies to fall behind. There's plenty of big data in every industry, especially banking and financial services. Except for dispensing cash from ATMs, there's nothing tangible. Every customer interaction simply generates electronic records that must be retained due to regulatory requirements. Thanks to big data analytics, financial services firms are no longer simply storing data as required; they're actively using it in order to generate business insights and add value.

Customers are expecting a more personalized service from their banks. Regulators have reacted to the credit crunch with significant changes to regulation with more intrusive and granular supervision. At the same time, according to the EMC-sponsored IDC Digital Universe study, the world's data is doubling every two years with 1.8 trillion gigabytes expected to be created in 2011. A challenge for the industry is, therefore, how to use the breadth and depth of data available to satisfy more demanding regulators, but also improve services for customers.

The opportunity for the sector is to unlock the potential in the data through analytics and shape the strategy for business through reliable factual insight rather than intuition. Recognizing that data is a significant corporate asset, a number of organizations are appointing chief data officers following pressure to police the integrity of the numbers (Economist Special Report, 2010). This pressure is driven by business leaders wanting more consistency in information and by regulators becoming increasingly concerned at the quality of data they receive during a time when regulatory demands are growing. This is made clear by the increasing number of references to integrity of data in each new regulatory requirement. For example, Solvency II requires insurers to have "internal processes and procedures in place to ensure the appropriateness, completeness and accuracy of the data". These processes and procedures could (and usually do) involve technology, but should also include data policies, standards, roles and responsibilities to ensure data integrity is appropriately governed.

While it is crucial to ensure the integrity of data provided to executive management and regulators, unlocking the insights in the data to better understand customers, competitors and employees represents a significant opportunity to gain competitive advantage. While regulatory pressure is forcing organization's to improve the integrity of the data, many financial institutions are seeing improved data quality and the use of analytics as an opportunity to fundamentally change the way decisions are made and to use the data for commercial gain.

Big data should also involve using multiple data sources, internally and externally. Geo-spatial data, social media, voice, video and other unstructured data all have their part to play in knowing the customer today and their future behaviours. For example, leading firms are looking at using both internal and external data, both structured and unstructured, to develop personalised banking products. Customers are more likely to be attracted and retained with personalised products - hence, lifetime value goes up. Similarly, analytics have an increasingly important part to play in the recovery of bad debt. Recoveries functions typically target based on the delinquency status of the account. However, a better understanding of customer circumstances can improve targeting and have an immediate impact on recovery rates while also reducing cost.

There is no doubt that harnessing the power of big data can enhance organizational performance. However, it is not a technological question. It is a strategic one about how an organisation derives genuine insight from their data and changes the way they interact with customers, competitors and the market through fact-driven decision-making. Those organisations that master this will set the trend in customer service, improve profitability and respond more rapidly to the evolving regulatory and competitive demands of the industry.

Most of the big data analytics that these businesses perform happen in real time to drive immediate decision-making. Here are five of the most common use cases where banks and financial services firms are finding value in big data analytics.

BIG DATA ANALYTICS TECHNIQUES IN FINANCIAL SERVICES

Much of the current debate around big data is locked in technological advancements. This misses the point that the real strategic value in the data is the insight it can give into what will happen in the future. Predicting how customers and competitors' customers will behave and how that behavior will change is critical to tailoring and pricing products. Big data should be about changing the way you do business to harnesses the real value in your data, re-shape the interaction with the market and increase the lifetime value of your customers. Therefore, which data is required to achieve these objectives, who needs it and how often are key pieces of the big data puzzle.

Sentiment Analysis

Sentiment analysis (aka opinion mining) applies natural-language processing, text analysis and computational linguistics to source material to discover what folks really think. Now a days data analytics techniques are being used to:

- Build algorithms around market sentiment data (e.g., Twitter feeds) that can short the market when disasters (e.g., storms, terrorist attacks) occur
- Track trends, monitor the launch of new products, respond to issues and improve overall brand perception
- Analyze unstructured voice recordings from call centers and recommend ways to reduce customer churn, up-sell and cross-sell products and detect fraud

Some data companies are even acting as intermediaries, collecting and selling sentiment indicators to retail investors.

Real-Time Analytics

Now a days financial institutions were hampered by the lag-time between data collection and data analysis. Real-time analytics short-circuits this problem and provides the industry with new ways to:

- **Fight Financial Fraud:** Banks and credit card companies routinely analyze account balances, spending patterns, credit history, employment details, location and a load of other data points to determine whether transactions are above aboard. If suspicious activity is detected, they can immediately suspend the account and alert the owner.
- **Improve Credit Ratings:** A continuous feed of online data means credit ratings can be updated in real time. This provides lenders with a more accurate picture of a customer's assets, business operations and transaction history.
- **Provide More Accurate Pricing:** Progressive Insurance already tailors its policies to account for a customer's changing financial situation. In the Internet of Things, data from automobile sensors will also help insurance companies' issues its policy holders with warnings about accidents, traffic jams and weather conditions. That makes for safer drivers and fewer payouts.

The Billion Prices project is an example of this phenomenon in action. Frustrated with the lag time on the U.S. Bureau of Labor Statistics's consumer price index (CPI), MIT's Alberto Cavallo and Roberto Rigobon turned to information from the web. Every day, their software collected half a million prices of products sold in the U.S. and analyzed the results. In 2008, just after Lehman Brothers filed for bankruptcy, their tool was able to detect a deflationary swing in prices far earlier than the official CPI report did. Today, banks and other major financial institutions use PriceStats (the project's commercial spinoff) to analyze inflation trends around the world.

Customer Segmentation

Customer Segmentation is the subdivision of a market into discrete customer groups that share similar characteristics. Customer Segmentation can be a powerful means to identify unmet customer needs. Companies that identify underserved segments can then outperform the competition by developing uniquely appealing products and services. Customer Segmentation is most effective when a company tailors offerings to segments that are the most profitable and serves them with distinct competitive advantages. This prioritization can help companies develop marketing campaigns and pricing strategies to extract maximum value from both high- and lowprofit customers. A company can use Customer Segmentation as the principal basis for allocating resources to product development, marketing, service and delivery programs. Customer Segmentation requires managers to:

- Divide the market into meaningful and measurable segments according to customers' needs, their past behaviors or their demographic profiles
- Determine the profit potential of each segment by analyzing the revenue and cost impacts of serving each segment
- Target segments according to their profit potential and the company's ability to serve them in a proprietary way
- Invest resources to tailor product, service, marketing and distribution programs to match the needs of each target segment
- Measure performance of each segment and adjust the segmentation approach over time as market conditions change decision making throughout the organization

Like every other industry, banks and financial institutions are hungry to know more about the people using their products and services.

Financial Companies use Customer Segmentation to:

- Prioritize new product development efforts
- Develop customized marketing programs
- Choose specific product features
- Establish appropriate service options

- Design an optimal distribution strategy
- Determine appropriate product pricing

Predictive Analytics
By combining segmentation with predictive analytics, companies can also cut down on risk. For example, to decide whether certain customers are likely to pay off their credit cards, some major banks use technology developed by the company. This analysis takes into account the demographic characteristics of customers' neighborhoods and makes calculated predictions. Similar strides have been made in forecasting market behavior. Once upon a time (e.g., 2009), high-frequency trading – the speedy exchange of securities – was hugely lucrative. With competition came a drop in profits and the need for a new strategy.

HFT traders adapted by employing strategic sequential trading, using big data analytics to identify specific market participants and anticipate their future actions. In a field of breakneck speed, this gives HFT traders an unmistakable advantage. Predictive analytics can also be used to issue early warnings on the market. In their paper, Quantifying Trading Behavior in Financial Markets Using Google Trends, Tobias Preis, Helen Susannah Moat and H. Eugene Stanley focused on the behavior of search engine users. By studying search volume data provided by Google Trends, they were able to identify online precursors for stock market moves. Their results suggest that increases in search volume for financially relevant search terms usually precede big losses in financial markets.

Fraud Detection
Banks and financial services firms use analytics to differentiate fraudulent interactions from legitimate business transactions. By applying analytics and machine learning, they are able to define normal activity based on a customer's history and distinguish it from unusual behavior indicating fraud. The analysis systems suggest immediate actions, such as blocking irregular transactions, which stops fraud before it occurs and improves profitability.

Personalized Marketing
One step beyond segment-based marketing is personalized marketing, which targets customers based on understanding of their individual buying habits. While it's supported by big data analysis of merchant records, financial services firms can also incorporate unstructured data from their customers' social media profiles in order to create a fuller picture of the customers' needs through customer sentiment analysis. Once those needs are understood, big data analysis can create a credit risk assessment in order to decide whether or not to go ahead with a transaction.

Risk Management
While every business needs to engage in risk management, the need may be largest in the financial industry. Regulatory schemes such as Basel III require firms to manage their market liquidity risk through stress testing. Financial firms also manage their customer risk through analysis of complete customer portfolios. The risks of algorithmic trading are managed through backtesting strategies against historical data. Big data analysis can also support real-time alerting if a risk threshold is surpassed.

BIG DATA TRENDS IN FINANCIAL SERVICES

In the past year, the big data pendulum for financial services has officially swung from passing fad or experiment to large deployments. That puts a somewhat different slant on big data trends when compared to previous year's trends. The question of big data hype versus reality has finally been put to rest for banks. This is further supported by the upward trending spend on big data solutions in financials. Bear in mind that the trends and themes discussed here apply to next-generation infrastructure solutions and quantitative approaches that have come to market over the past seven to ten years. The past year squarely put the ROI and value generated from these efforts into question. This is not only evidenced by discussion from management consulting reports [28], but also by the change in CIO and CDO positions at many banks, as these financial executives have been increasingly scrutinized after several years of spending. While the hype has subsided, banks appreciate that big data is not a panacea for all woes. Of course, big data remains vital to reducing overall IT operating costs and delivering advanced data capabilities.

As we anticipated last year, risk, compliance, and marketing are the focus for major banks globally. Risk and compliance naturally continue to be most pressing for SIFIs or G-SIBs, as major mandates tied to heightened capital controls, risk oversight, and data management are coming into effect. Examples include Basel III, FRTB (Fundamental Review of the Trading Book), and MiFID II (Markets in Financial Instruments Directive). The one theme that remains consistent is that banks are wringing costs from legacy reporting and storage, and are offloading analytic workloads and utilizing "next generation" big data solutions.

By looking at the overall market, the key trends expected to reverberate through 2017 in the financial services industry are [27]:

Banks march to the public cloud

What was once deemed as principally unrealistic for banks is now a reality. Bank adoption of cloud solutions remains strong, and is occuring at banks in a variety of ways. Although private clouds have dominated the past several years, in the coming year we'll see a marked increase in large projects to test, and a hardening of hybrid cloud environments. The goal is to gain a clearer view of what a manageable path for large public cloud adoption looks like for financial services. This is not only true for storage and compute, but also for agile applications development. Banks will need to crack the code for big data management and to master nuances of updating, synchronizing, and governing data assets to effectively solve this.

Fraud and financial crimes take center stage

The 2016 Wells Fargo account scandal only highlighted how stakes are raised for fraud each year, with 2017 being no exception. Fines are climbing, and sanctions compliance demands have forced banks to increase their transaction monitoring, KYC compliance (Know Your Customer), and money laundering detection and prevention efforts. Regulatory agencies will also increase their scrutiny of business practices and investigation of potential financial crimes. Data management and new generation analytics are key tools to improve fraud detection and criminal activity. Therefore, expect risk data aggregation, model risk, and data analytics to be the focus for banks.

Financial data governance improving though still limiting adoption

Since last couple of years, the solutions for big data governance have improved. However, the conversation for banks regarding big data is still largely focused on centralization efforts and data lakes. Bank Chief Data Officers' (CDOs) importance is growing. CDOs are becoming less likely to put big data governance processes in their own bucket, but are instead incorporating its data governance into overall bank plans. There is a fair amount of consensus among banking CDOs that there are no single solutions or tools that enable data governance within data lakes. The focus will be on adopting solutions that will manage critical aspects (lineage, wrangling, prep, quality) of the overall governance practice to realize greater usage of data lake environments.

Converged applications to integrate historical and real-time financial data

Financial firms, such as institutional traders, payments, and credit card providers have always stored historical data and increasingly they are analyzing and making decisions based on these data stores. These firms have also made substantial improvements over the last decade to real-time environments. The integration of both historical and real time data, which leverages larger data volumes, is where banks are putting more focus. Further, the integration of both operational and analytical systems is also taking place, putting transactional data in line with analytical or modeling data for vastly improved efficiency and faster time to market.

The ability to combine real-time operational data and historical data analytics into new converged application models using a micro-services development approach will become more common over the coming year.

Financial services turning to IoT and streaming

IoT was a large theme in big data circles this past year, and while obvious for some industries (i.e., P&C and multi-line insurance carriers or manufacturers), it was not an obvious choice for financials. The basic applications for the financial sector revolved around mobile or ATMs, and those remain important for this year. Re-examining the underlying aspect of IoT, which is 'things' sending and receiving data or streaming information from the

'edge' in a bi-directional manner is giving rise to a host of uses cases as the definition expands. In the financial sector, streaming data can expand the speed, access, and ubiquity of market data throughout a financial firm's trade lifecycle and lowering costs and usage.

Big data and blockchain move forward in financial services

Financial services saw some of the greatest interest in blockchain technology over the past year. This technology is still in its early stages, and there's still a lot of confusion about its usage and future in financial services. Ripe areas to explore are how blockchains may enhance big data security, blockchain analytics, or immutable compliance archives for transactional areas. State Street is one financial powerhouse that has indicated its commitment to going live with blockchain POCs in 2017 in areas such as syndicated loans, securities lending, and collateral management. Expect to see greater exploration and dialogue over the next year as to how blockchains will converge with big data platforms along with the testing of blockchain technology itself. This is still very much an early game.

The utility shift is well underway

Utility-based shared service models have seen substantial growth over the past several years in financial markets, but expect to see more strategic opportunities develop beyond the sell-side. Technologies such as blockchain, big data, advanced analytics, machine learning, and event streaming will increasingly underpin the next generation of data-driven processes. This will create opportunities to advance market structure, resiliency, and efficiency objectives, which serve as key areas for financial utilities. Symphony is a great early example on the technical communications side, and R3CEV/blockchain represents newer groups to facilitate data management. Buy-side, wealth management, and payments providers can look to the sell-side for examples of how to expel costs with consortium led utility models.

CONCLUSION

2017 will mark a particularly critical year for vendors and financial firms alike to partner together and ensure that large deployments are successful. This will usher in more opportunity to impact business productivity, and increase the pervasiveness and value of big data. The coming year will continue to see a strong uptake in core use cases for the financial sector. This includes not only the IT-focused use cases like warehouse offload, storage, and reporting, but also line of business applications such as risk and marketing. Fundamentals are the focus of big data projects for the coming year for a few reasons. First, banks, wealth management firms, asset managers, and insurance firms are non-digital natives, so the process of conversion is longer. Big data platforms require a fair amount of behavioral change—tools, functions, quality, and usage need agreement across business and technology groups. Without consensus, progress is hampered. Next, security for financials is and must be at the forefront of big data efforts to enable the expansion of new projects. If data is the new currency of banks, they must accordingly treat it as a monetary asset. More than 25% of financial firms have already implemented big data projects and are already obtaining a competitive advantage. Due to both regulatory requirements and the perceived value of big data analytics, financial firms will continue to implement big data analytics projects. This will require increased investments in data center technology as well as increased hiring of staff with big data skills. For value-added resellers, understanding their use cases will lead to additional opportunities to sell big data products and services.

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